Definitions Can Confuse: Why the "Neonative" Neologism Is Bad for Conservation

Species ranges are changing and changing rapidly in some instances for three main reasons. First, human-mediated dispersal means that species are moving around the world in greater numbers and in ways unlike natural dispersal (Ricciardi 2007, Wilson et al. 2009). Second, humans have modified the environment in ways that allow some species to expand their ranges to areas they were never previously found in. Third, some species have increased their ranges poleward and up mountains in response to human-induced climate change. Essl and colleagues (2019) argued that the last two phenomena need to be clearly distinguished from biological invasions (the first phenomenon) and natural dispersal. They propose that if humans modify the environment (directly or indirectly) in a way that allows a species to establish in areas where the species was not previously established, such populations need to be considered and managed separately from other populations. Furthermore, they propose classifying such populations using a new term, "neonative", distinguishing them from other native populations (presumably termed "paleonative"). Although this neologism encapsulates an important phenomenon, I believe it is not useful for four reasons: it is impractical, the link to policy and management is weak, the issue is inherently ephemeral, and the term "neonative" is already in use.

For the distribution of a species to be defined in terms of "neonative" and "paleonative" populations a line must be drawn on a map. Who decides where this line is drawn? Would different biogeographers draw the line in roughly the same place? If not, uncertainty could be encapsulated by drawing a buffer zone, but this requires two lines to be drawn on a map not one. Therefore, a rigorous universally accepted protocol is needed. But there is substantial uncertainty in the five characteristic features proposed to separate "neonative" and "paleonative" populations. (1) Range expansion beyond historic range—how are historic ranges defined, and how historic need the ranges be? (2) The facilitating role of human-induced environmental change—how does one demonstrate unequivocally that human-induced environmental change was responsible? (3) An absence of any human agency other than anthropogenic environmental change—how is this to be demonstrated, particularly given the many cases when range shifts will be due to the synergistic effects of human-aided dispersal and human-induced environmental change? (4) Population status of occurrences outside the historic native reference range—this is perhaps the least problematic as the issue has been discussed and protocols developed for alien species (Blackburn et al. 2011). (5) The timing of onset of range expansion beyond historic native reference range—what cut-off should be used? These uncertainties are acknowledged by Essl and colleagues (2019), and they argued that protocols can be developed to resolve them. I come to a different conclusion. The uncertainties are so great—and, in some cases, unresolvable—that it is inappropriate to start with the neologism and then try to work out how to implement it in practice.

Assuming a robust protocol can be developed, will resolving these issues be useful? Essl and colleagues (2019) argued that the "unclear situation [of "neonative" populations] in management and regulations warrants recognizing these species [sic] as a special category." However, the important practical challenges they identify do not require a neologism. The importance of considering biogeographical origin (native and alien) for biodiversity assessments and achieving conservation goals is contested by some but viewed as appropriate in many contexts (Pauchard et al. 2018, Simberloff et al. 2011). However, there is consensus that, for us to intervene, the focus should be on considering the impacts in the context of whatever value system is agreed on. This focus on impact is important regardless of whether

there is range expansion at a continental scale, whether populations are becoming more abundant in habitats at a landscape scale within their "paleonative" range (Nackley et al. 2017), or whether using assisted colonisation to create "neonative" populations is the only way to conserve species (Hoegh-Guldberg et al. 2008).

The "neonative" neologism as presented in the article is given an optional temporal cut-off of 1950 (the onset of the Anthropocene). But, as the article discusses in detail, the phenomenon and consequences of human-induced environmental change on the potential for species to expand their range dispersal did not start in 1950. The issue, again, comes down to drawing a line through a continuous process. This raises several important points. How do we deal with species that have no "paleonative" populations left? This is unfortunately a phenomenon that is likely to be common even with only a 2-degrees-Celsius rise in global temperatures. Should such species be viewed similarly to those that are extinct in the wild? Given species assemblages are likely to shift, does it make sense to split up populations of each species into "paleonative" and "neonative"? Should there be a temporal cut-off beyond which a "neonative" population should be considered as "paleonative"? These are interesting questions, and issues that also bedevil the study of biological invasion, but resolving them does not require the "neonative" neologism.

Finally, the term "neonative" is already in use: "A plant that has originated in the area without direct human involvement but has arisen as the result of hybridization either between a native and an alien taxon or between two alien taxa or as a result of evolution from an alien or neonative taxon" (p. 7 in Stace and Crawley 2015). This is clearly a concept that needs specification but one that would cause substantial confusion with the proposed "neonative" neologism.

I agree with Essl and colleagues (2019) that the phenomenon of range-expansion in response to human-induced environmental change is important and will become more so. However, although there is, in most cases, a clear dichotomy between alien and native populations, for practical and conceptual reasons, there is rarely a dichotomy between "neonative" and "paleonative" populations. For our understanding, it will be more important to focus on the mechanisms causing range expansion. For our biodiversity databases and collections, it will be more important to focus resources on taxonomic issues and addressing the alien and native dichotomy (Pyšek et al. 2013, Essl et al. 2018). And when making conservation decisions as to whether to manage populations, these should be explicit context-specific value judgments. Delineating the "neonative" neologism will likely only confuse these important challenges facing us.

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